

Pisces, Buenos and Guaratinguetá watersheds, eastern Serra da Mantiqueira, São Paulo, Brazil

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ABSTRACT: The fishes of the present study were collected in the Buenos and Guaratinguetá watersheds. In order to include regions of the slope, piedmont and the valley 15 collection points were marked, eight of them in the Buenos watershed and seven in the Guaratinguetá watershed. There were captured 2,805 individuals belonging to 34 species, 13 families and seven orders. In the Buenos watershed, there were 27 species and the Guaratinguetá watershed 30 species; four species were unique to streams of the Buenos watershed and eight to streams of the Guaratinguetá watershed. The list of fish species here presented is important for the knowledge on biodiversity in these environments.

INTRODUCTION

The Serra da Mantiqueira is one of the most important mountainous sets of the southeastern region, harboring significant remaining of the Atlantic rainforest. Located at the interface between the states of Minas Gerais, São Paulo and Rio de Janeiro, it represents the great watershed of Paraíba do Sul and Paraná rivers. The Paraíba do Sul river basin, part of the Leste basin, is located in the Vale do Paraíba, where in the northwest are the eastern mountains of Serra da Mantiqueira (Ponçano *et al.* 1981). From the mountains' slopes descend numerous streams that form distinct watersheds, isolated by steep ridges of relief, which drain into the Paraíba do Sul river (Braga 2004).

The Buenos and Guaratinguetá watersheds are examples of these systems that come down the slopes of the eastern Serra da Mantiqueira, being isolated from other systems by contiguous relief formations. This study provides a list of fish species from two watersheds with the intention to contribute to the knowledge of the biodiversity in these environments.

MATERIALS AND METHODS

Study Area

Headwaters of the Buenos stream are located about 1,950 meters above sea level, going down abruptly the escarpment of the eastern Serra da Mantiqueira, outflowing into the Paraíba do Sul river, at elevation of 550 meters. It travels about 20 km in that route. Its main tributaries are the Guamirim and Guarulhos streams. Headwaters of the Guaratinguetá river are located about 850 meters in the piedmont of the eastern Serra da Mantiqueira. Today, headwaters are completely silted up, taken by cattle, and its water flow stopped. Its main tributaries are the Pirutinga and Taquaral streams, their source start about 1,900 meters of altitude, forming the main course, which travels a route of about 25 km to its mouth, in the Paraíba do Sul river.

Fish sampling

In order to include regions of the slope, piedmont and the valley 15 collection points were marked, eight of them in the Buenos watershed and seven in the Guaratinguetá watershed (Figure 1). Sampling took place over a year (in May, August and November of 2008 and February of 2009), and the following fishery equipment was used: electric fishing equipment, gill nets and sieve (Table 1).

In the sample points which the electric fishing equipment was used, stretches of 50 m were selected, where the equipment was passed twice without a contention net. In the sample points which gill nets were used (with mesh sizes varying from 3–9 cm between adjacent knots), the sequence of nets was determined at random and remained submerged from the end of the day until the next morning. A sieve was used on bank vegetation for ten times in samples sites which were sampled with gill nets.

Fishes were fixed with 10% formalin and, after 48 hours, transferred to 70% alcohol solution. Species were identified by experts of each fish group. Voucher specimens were deposited in the ichthyological collection of the Ichthyology Laboratory of *Universidade Estadual Paulista*, in Rio Claro and São José do Rio Preto. The taxonomic classification system used followed Reis *et al.* (2003) and Eschmeyer (2010). Fishes were collected with IBAMA/MMA/SISBIO permission (15754-1).

RESULTS AND DISCUSSION

A total of 2,805 individuals were collected in the whole period, belonging to 34 species, which are distributed in 13 families and seven orders (Table 2); 27 species were captured in the Buenos watershed and 30 in the Guaratinguetá watershed. Four species were unique to streams of the Buenos watershed and eight to streams of the Guaratinguetá watershed.

Several surveys of the fish fauna of the Paraíba do Sul river have been performed, either in different parts

of the main channel (upper, upper-middle, middle-lower and lower) and/or its major tributaries (Araújo 1996; 1998, Bizerril 1999, Araújo et al. 2001, Teixeira et al. 2005, Pinto et al. 2006, Araújo et al. 2009). About 130 species of freshwater fish occur in the Paraíba do Sul river, according to estimates of Bizerril (1999), including the survey of the fish fauna of small streams. However, knowledge of the composition of fish communities in the small streams that form the tributary watersheds of the Paraíba do Sul river is still scarce, restricted to the work of Braga and Andrade (2005), in streams of the Ribeirão Grande watershed, and Ingenito and Buckup (2007) in some sampling points in Ribeirão Grande, Buenos and Piracuama streams. Bizerril (1999) characterized the region of the Alto Paraíba do Sul river systems and associated tributaries as a zone of endemism, where large groups of species can be found, dating from a period of connection of systems Tietê / Paraíba. In the Ribeirão Grande watershed, Braga and

Andrade (2005) sampled 37 species, the most abundant two small-sized fishes, *Characidium lauroi* and *C. alipioi*. Ingenito and Buckup (2007) compiled 25 species in Ribeirão Grande stream, 18 in Piracuama stream and 6 for the Buenos stream.

A single exotic species, the rainbow trout (*Oncorhynchus mykiss*), was found during the survey in the piedmont region of the Guaratinguetá watershed. In the headwaters of this watershed, the trout farming is common in fish tanks and pay lakes. Probably, this individual escaped from one of these tanks, and was captured downstream. Non-native species (e.g. *Tilapia* spp., *Oreochromis* spp., *Poecilia* spp., *Cichla* spp., *Aequidens* sp.) have been reported in several studies in Paraíba do Sul river (Araújo 1996; 1998, Araújo et al. 2001, Teixeira et al. 2005, Pinto et al. 2006, Araújo et al. 2009). However, for the tributary streams of the watershed of the river Paraíba do Sul, no record was found (Braga and Andrade 2005, Ingenito and Buckup 2007).

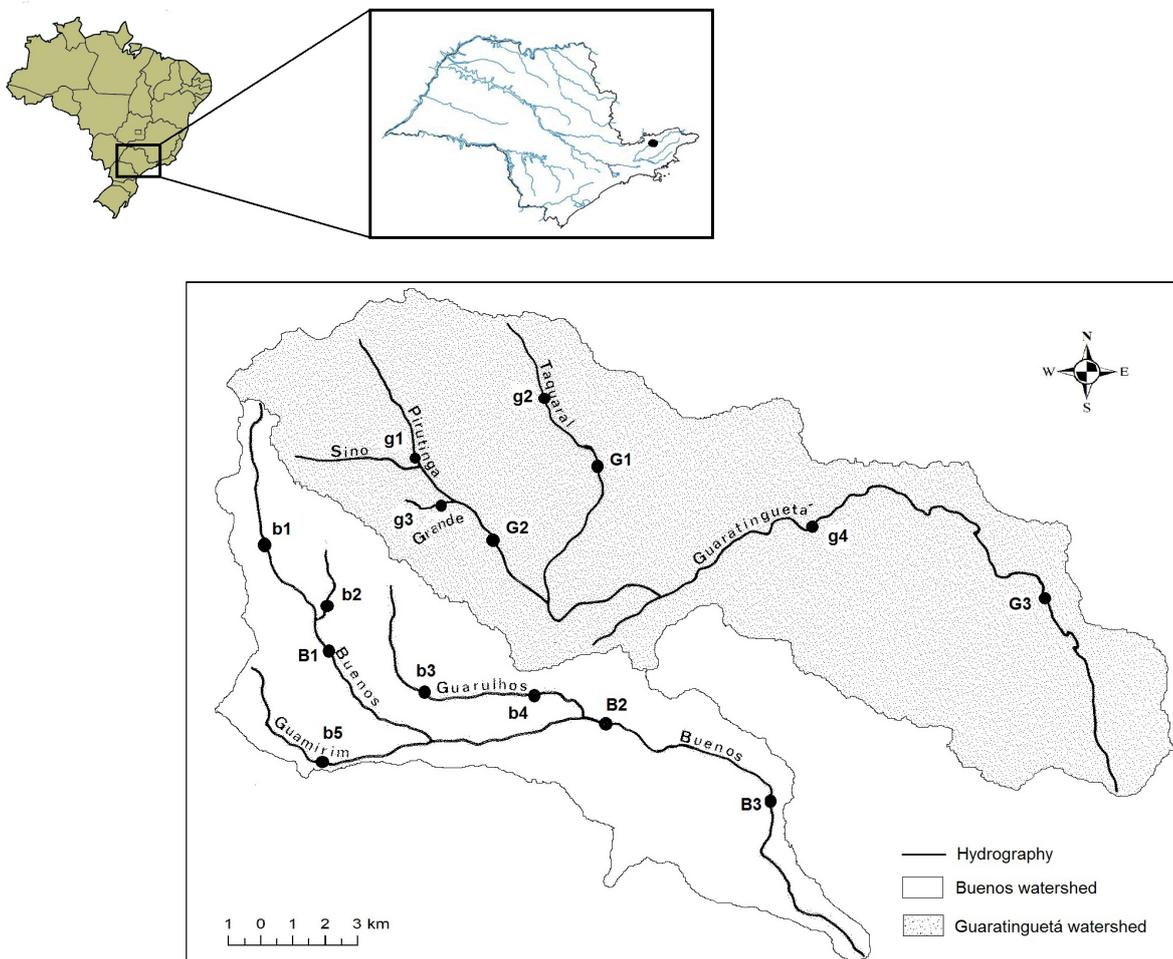


FIGURE 1. Hydrographic map of the Buenos and Guaratinguetá watersheds, showing the sampled sites.

TABLE 1. Geographic coordinates of collection points, streams, sampled watersheds and fishery equipment used.

COLLECTION POINT	COORDINATES	STREAM	WATERSHED	FISHERY EQUIPMENT USED
B1	22°46'30.9" S, 45°24'44.5" W	Buenos	Buenos	Electric fishing equipment
B2	22°47'42.7" S, 45°17'52.8" W	Buenos	Buenos	Electric fishing equipment
B3	22°47'53.3" S, 45°18'33.8" W	Buenos	Buenos	Gill nets/sieve
G1	22°43'29.1" S, 45°18'33.8" W	Taquaral	Guaratinguetá	Electric fishing equipment
G2	22°44'25.3" S, 45°22'23.8" W	Pirutinga	Guaratinguetá	Electric fishing equipment
G3	22°45'19.6" S, 45°13'39.2" W	Guaratinguetá	Guaratinguetá	Gill nets/sieve
b1	22°45'07.3" S, 45°25'39.7" W	Buenos	Buenos	Electric fishing equipment
b2	22°43'48.0" S, 45°28'24.0" W	Buenos	Buenos	Electric fishing equipment
b3	22°46'92.7" S, 45°23'29.2" W	Guarulhos	Buenos	Electric fishing equipment
b4	22°46'61.9" S, 45°21'77.0" W	Guarulhos	Buenos	Electric fishing equipment
b5	22°47'24.4" S, 45°25'45.2" W	Guamirim	Buenos	Electric fishing equipment
g1	22°42'39.2" S, 45°23'40.3" W	Pirutinga	Guaratinguetá	Electric fishing equipment
g2	22°42'49.3" S, 45°21'19.2" W	Taquaral	Guaratinguetá	Electric fishing equipment
g3	22°43'26.8" S, 45°24'05.2" W	Ribeirão Córrego Grande	Guaratinguetá	Electric fishing equipment
g4	22°44'22.7" S, 45°17'11.7" W	Guaratinguetá	Guaratinguetá	Electric fishing equipment

TABLE 2. List of the species captured in the Buenos and Guaratinguetá watersheds, following the taxonomic classification system by Reis *et al.* (2003) and Eschmeyer (2010).

TAXON	COLLECTION POINT
OSTARIOPHYSI	
CHARACIFORMES	
Crenuchidae	
<i>Characidium alipioi</i> Travassos, 1955	B1, B2, B3, b3, b4, G1, G2, g4
<i>Characidium lauroi</i> Travassos, 1949	B1, b1, b2, b5, G1, G2
Erythrinidae	
<i>Hoplerythrinus unitaeniatus</i> (Agassiz, 1829)	B3, G3
Genera Incertae Sedis	
<i>Astyanax bimaculatus</i> (Linnaeus, 1758)	B2, B3, b4, b5, G3, g4
<i>Astyanax fasciatus</i> (Cuvier, 1819)	B2, B3, G3, g4
<i>Astyanax intermedius</i> Eigenmann, 1908	b4, G1, G2
<i>Oligosarcus hepsetus</i> (Cuvier, 1829)	B2, B3, G3, g4
SILURIFORMES	
Trichomycteridae	
<i>Trichomycterus iheringi</i> (Eigenmann, 1917)	B1, B2, b3, b4, G2, g4
<i>Trichomycterus itatiayae</i> Miranda Ribeiro, 1906	B1, b1, b2, b3, b5, G1, G2, g1, g2, g3
<i>Trichomycterus</i> sp.	b3
Callichthyidae	
<i>Hoplosternum littorale</i> (Hancock, 1828)	G3, g4
Loricariidae	
Neoplecostominae	
<i>Neoplecostomus microps</i> (Steindachner, 1877)	B1, b1, b2, b3, b4, b5, G1, G2, g2, g4
Hypoptopomatinae	
<i>Hisonotus notatus</i> Eigenmann and Eigenmann, 1889	B3
<i>Pseudotocinclus parahybae</i> Takako, Oliveira and Oyakawa, 2005	B2
Loricariinae	
<i>Harttia carvalhoi</i> Miranda Ribeiro, 1939	B1, G1, G2
<i>Rineloricaria kronei</i> (Miranda Ribeiro, 1911)	B2, b4, G3, g4
Hypostominae	
<i>Hypostomus luetkeni</i> (Steindachner, 1877)	B3, G3

TABLE 2. CONTINUED.

TAXON	COLLECTION POINT
<i>Hypostomus</i> sp.1	g4
<i>Hypostomus</i> sp.2	B3, G3
<i>Hypostomus</i> sp.3	G3
<i>Pareiorhina rudolphi</i> (MirandaRibeiro, 1911)	B1, b3, G1, G2, g2
<i>Pareiorhina brachyrhyncha</i> Chamon, Aranda and Buckup, 2005	B1, b3, G1, G2, g2
Ancistrinae	
<i>Ancistrus stigmaticus</i> Eigenmann and Eigenmann, 1889	B2, G3, g4
Heptapteridae	
<i>Pimelodella</i> sp.	B2, G3
<i>Rhamdia</i> sp.	B3, G3, g4
<i>Taunaya bifasciata</i> (Eigenmann and Norris, 1900)	G2
Pimelodidae	
<i>Pimelodus maculatus</i> Lacèpede, 1803	G3
GYMNOTIFORMES	
Gymnotidae	
<i>Gymnotus carapo</i> Linnaeus, 1758	B2, G3, g4
<i>Gymnotus pantherinus</i> (Steindachner, 1908)	B1, B2, b4
CYPRINODONTIFORMES	
Poeciliidae	
<i>Phalloceros caudimaculatus</i> (Hensel, 1868)	B1, b5, G1
SYNBRANCHIFORMES	
Synbranchidae	
<i>Synbranchus marmoratus</i> Bloch, 1795	B2, g4
PERCIFORMES	
Cichlidae	
<i>Crenicichla lacustris</i> (Castelnu, 1855)	G3
<i>Geophagus brasiliensis</i> (Quoy and Gaimard, 1824)	b5, G3, g4
SALMONIFORMES	
Salmonidae	
<i>Oncorhynchus mykiss</i> (Walbaum, 1792)	G2

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ERRATUM

An information was missing in the caption for Figure 1, page 072, that should be read as follows:

FIGURE 1. Hydrographic map of the Buenos and Guaratinguetá watersheds, showing the sampled sites (modified from Lourenço *unpublished data*).

We apologize and are grateful for your comprehension.

The authors.

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